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CORNING GLASS WORKS

ELECTRO-OPTICS LABORATORY

RALEIGH, NORTH CAROLINA

IMPROVED SCREEN FOR REAR PROJECTION VIEWERS

Technical Report No. - 5

Date - December 14, 1965

Period Covered - November 15, 1965
to
December 15, 1965

EXCLUDED FROM AUTOMATIC

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Technical Report #5

This period saw the conclusion of the first phase of this program which was devoted to a literature search of the open and patent literature on rear projection screens and related topics. The results of this were reported along with some preliminary investigations in Technical Report #4. We also started the second phase of the program concerned primarily with theoretical investigations, but also with instrumentation and preliminary investigations of CGW materials.

1. Theoretical Studies

A theoretical investigation of Rayleigh scattering materials was begun, aimed at determining the feasibility of using materials with Rayleigh scatterers as rear projection screens. Rayleigh scattering theory was first considered and the general scattering function was developed. Separate terms in the scattering function were then considered individually and numerically evaluated to better understand how they contribute to the scattering function. The most important terms are

a. Dependence on the Refractive index of the Particles Relative to the Supporting Matrix

b. Wavelength Dependence

c. Angular Dependence

d. Polarization Considerations

We have been able to show theoretically that it is not possible, using only single scattering, to produce rear projection screens with satisfactory color characteristics. It appears as though only multiple Rayleigh scattering can significantly improve the color fidelity of these materials. The details of multiple

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scattering are by far more complex than single scattering theory but they will be considered in detail along with other associated problems such as overall efficiency and the influence of screen thickness and the scattering function on resolution.

2. Investigations of Corning Glass Works Materials

a. Porous Vicor

During this period we have received samples of porous Vicor brand glass[1] from our facilities in Corning, New York. These have been treated to fill the open spaces, produced in the glass by leaching, with varying concentrations of two different opalizing agents. These are being investigated to determine the influence of the opalizing agents on the scattering properties of the glass and to give a better understanding of the basic limits of this type of material. We also expect to have electron microscope data on the size of the particles in these samples by next period.

b. Reflective Coating of Hollow Fibers

We are continuing to investigate how to apply highly reflective coatings on the inside and outside of hollow fibers. Preliminary results of our initial work are also expected next period. Several different techniques are being considered and are being checked on a small scale using realistically sized fibers.

In connection with this we are requesting samples of hollow fiber matrices. We will investigate techniques to put a reflective coating in these fibers and subsequently determine their optical properties.

[redacted] "Improved Screen for Rear Projection Viewers", Technical Report No. 4, November 5, 1965.

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3. Instrumentation

a. Goniophotometer

Design of a goniophotometer was begun. The optical design has been completed and components are on order. Design work on the remainder of the instrument will be concluded next period with construction occupying all of the following period.

b. Modulation Transfer Function Analyzer

Design of a modulation transfer function analyzer which will be used to determine screen resolution will start next period. It will be specially designed taking into consideration the unique characteristics of rear projection screens. It will allow resolution measurements for other than on axis viewing and duplicate as nearly as possible a rear projection system.

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